ETA8220

18V, 2A, High Efficiency Synchronous Step-Down Converter in SOT23-6

DESCRIPTION

ETA8220 is a wide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. It adopts an Adaptive COT control scheme that enables very fast transient response and provides a very smooth transition when the output varies from light load to heavy load. During light load, ETA8220 goes into a PFM mode that saves switching loss achieving high efficiency. The adaptive COT control also maintains a constant switching frequency across line and load.
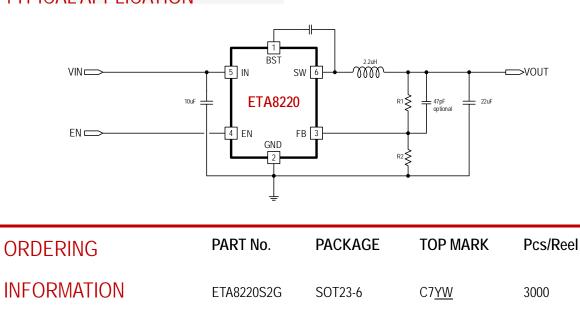
ETA8220 is available in SOT23-6 package.

FEATURES

- Wide Input Range: 4.5V-18V
- Adaptive COT Control
- Ultra-fast load transient response
- High Efficiency PFM mode at light load
- High Efficiency Synchronous operation
- No load Iq 210uA
- Low Rdson Internal power FETs
- Capable of Delivering 2A
- No External Compensation Needed
- Thermal Shutdown and UVLO
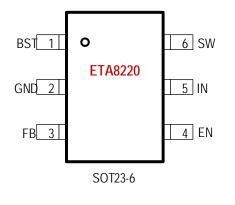- Available in SOT23-6 Package

APPLICATIONS

- LCD TV
- Set Top Box
- xDSL Modem

TYPICAL APPLICATION

ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA8220S2G	SOT23-6	C7YW	3000

ETA8220

PIN CONFIGURATION

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        ┌─────────────┐
BST  1 ─┤  ○          ├─ 6  SW
        │   ETA8220   │
GND  2 ─┤             ├─ 5  IN
        │             │
FB   3 ─┤             ├─ 4  EN
        └─────────────┘
           SOT23-6
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ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

IN, EN Voltage ....–0.3V to 19V
SW Voltage.....–0.3V (-5V for <10nS) to 19V (23V for <10nS)
BST Voltage ....–0.3V to SW+6V
FB Voltage ....–0.3V to 6V
Operating Temperature Range ....–40°C to 85°C
Storage Temperature Range ....–55°C to 150°C
Thermal Resistance θ_{JA} θ_{JC}
SOT23-6.....................180.............90........................... °C/W
Lead Temperature (Soldering 10ssec) ....260°C
ESD HBM (Human Body Mode) 2KV
ESD MM (Machine Mode) 200V

ELECTRICAL CHARCTERISTICS

(V_{IN} = 12V, V_{OUT} = 3.3V, unless otherwise specified. Typical values are at T_A = 25°C.)

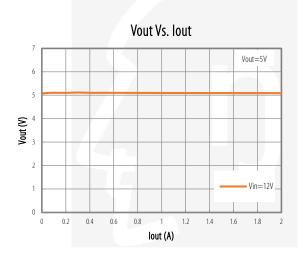| PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		4.5		18	V
Input UVLO	Rising		4.05		V
Input OVP			19		V
Input Supply Current	no switching		210		µA
Input Shutdown Current			7	14	µA
FB Voltage		0.588	0.6	0.612	V
FB Input Current			0.05		µA
Switching Frequency			600		KHz
Maximum Duty Cycle			90		%
Short Circuit Hiccup Time	On Time		2		mS
	Off Time		6		mS
FB Hiccup Threshold			0.2		V
High Side Switch On Resistance			160		mΩ
Low Side Switch On Resistance			95		mΩ
High Side Current Limit			4.2		A
SW Leakage Current	IN=SW=12V			10	µA
EN Rising Threshold	Rising,		1.5		V
EN Falling Threshold	Falling		1.3		V
EN Input Current	V_{EN}=2V		1		uA
Thermal Shutdown	Rising, Hysteresis =36°C		150		°C

PIN DESCRIPTION

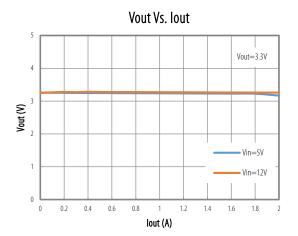| PIN #	NAME	DESCRIPTION
1	BST	Bootstrap pin. Connect a 10nF capacitor from this pin to SW
2	GND	Ground
3	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}
4	EN	Enable pin for the IC. Drive this pin high to enable the part, low or floating to disable.
5	IN	Supply Voltage. Bypass with a 10µF ceramic capacitor to GND
6	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.

TYPICAL CHARACTERISTICS

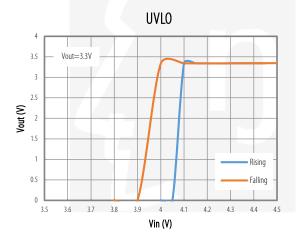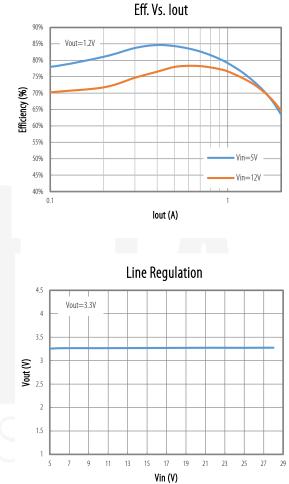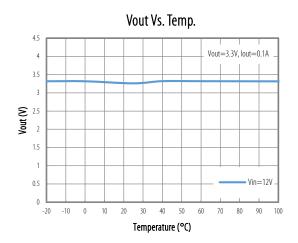(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

TYPICAL CHARACTERISTICS (cont')

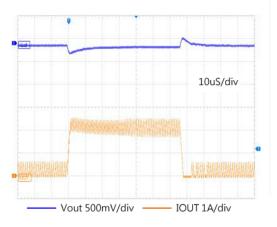(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

Vout Vs. Iout

Eff. Vs. Iout

UVLO

Line Regulation

Vout Vs. Temp.

TYPICAL CHARACTERISTICS (cont')

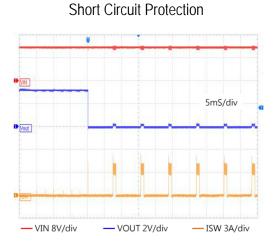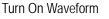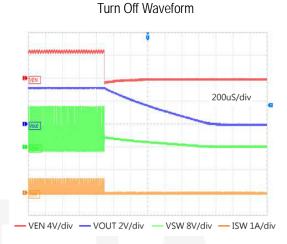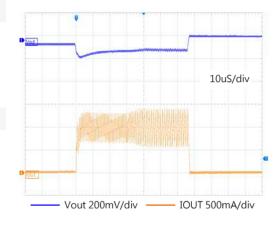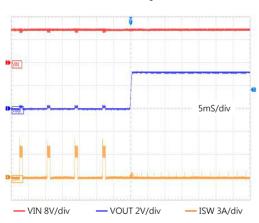(Typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

Turn On Waveform

200uS/div

— VEN 3V/div — VOUT 2V/div — VSW 10V/div — ISW 2A/div

Turn Off Waveform

200uS/div

— VEN 4V/div — VOUT 2V/div — VSW 8V/div — ISW 1A/div

3.3V 0.1-2A Transient Response

10uS/div

— Vout 500mV/div — IOUT 1A/div

3.3V 0-1A Transient Response

10uS/div

— Vout 200mV/div — IOUT 500mA/div

Short Circuit Protection

5mS/div

— VIN 8V/div — VOUT 2V/div — ISW 3A/div

Recovery
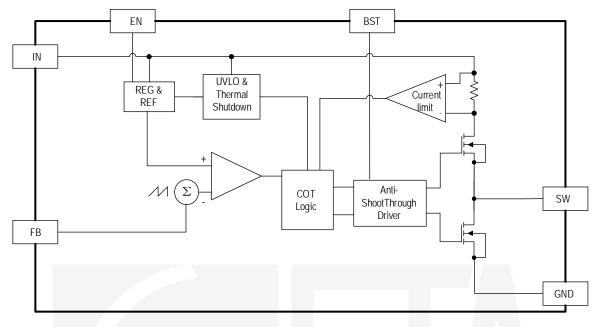

5mS/div

— VIN 8V/div — VOUT 2V/div — ISW 3A/div

FUNCTIONAL BLOCK DIAGRAM

FUNCTIONAL DESCRIPTION

The ETA8220 is a synchronous buck regulator ICs that integrates the adaptive COT control, top and bottom switches on the same die to minimize the switching transition loss and conduction loss.

ETA8220 is a wide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. It adopts an Adaptive COT control scheme that enables very fast transient response and provides a very smooth transition when the output varies from light load to heavy load. It compares the sum of the FB voltage and a ripple voltage that mimics the voltage due to the output ESR and capacitance. The constant-on-time timer varies with line to achieve relative constant switching frequency across line.

Light Load Operation

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFET, power is lost due to the finite Rdson of the MOSFET and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ETA8220 goes into a power save mode during light load, thereby extending the range of high efficiency operation.

Enable

EN is a digital control pin that turns the ETA8220 on and off. Drive EN High to turn on the regulator, drive it Low to turn it off. An internal 1MΩ resistor from EN pin to GND allows EN to float to shut down the chip. Connecting the EN pin through a pull up resistor or shorted EN to IN will automatically turn on the chip whenever plug in IN.

Over Current Protection and Hiccup

ETA8220 has a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UV threshold (0.2V), the ETA8220 will enter hiccup mode. It will turn off the chip immediately for 6mS. After that, it will try to re-starts as

normal for 2mS. After 2mS, if FB is still below UV threshold, then the chip enters hiccup mode again. If FB is higher than UV threshold, it will enter the normal mode.

Over-Temperature Protection

Thermal protection disables the output when the junction temperature rises to approximately 150°C, allowing the device to cool down. When the junction temperature cools to approximately 110°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as a result of overheating.

APPLICATION INFORMATION

External Output Voltage Setting

In external Output Voltage Setting Version selected, the ETA8220 regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R_1}{R_2}\right)$$

Where: VREF =0.6V typically (the internal reference voltage)

Resistors R2 has to be between 1kOhm to 70KOhm and thus R1 is calculated by following equation.

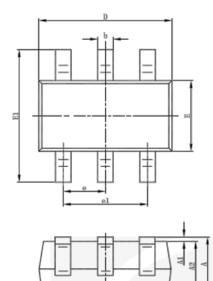$$R_1 = \left(\frac{V_{OUT}}{V_{REF}} - 1\right) \times R_2$$
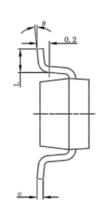
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PCB LAYOUT GUIDE

GND trace is used to shield the FB(sensitive node); GND trace goes underneath the IC body to have shorter connection to Cin;Cin has to be placed very close to Vin and GND pins
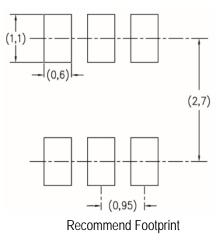
PACKAGE OUTLINE

Package: SOT23-6

Recommend Footprint

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°